

CLAIMS

We claim:

[c1] 1. A method of manufacturing a microelectronic device having a die with an integrated circuit, the method comprising:
 forming a bond-pad on the die, wherein the bond-pad is electrically coupled to the integrated circuit;
 forming a redistribution layer on the die, the redistribution layer including a conductive line having a first end portion attached to the bond-pad and a second end portion spaced apart from the bond-pad;
 forming a passage through the die, the bond-pad, and the first end portion of the conductive line; and
 depositing an electrically conductive material into at least a portion of the passage, wherein the electrically conductive material extends through the bond pad.

[c2] 2. The method of claim 1, further comprising applying a passivation layer to at least a portion of the passage before depositing an electrically conductive material into at least a portion of the passage.

[c3] 3. The method of claim 1, further comprising:
 cleaning the passage after forming the passage through the die, the bond-pad, and the first end portion of the redistribution layer; and
 applying a passivation layer to at least a portion of the passage before depositing an electrically conductive material into at least a portion of the passage.

[c4] 4. The method of claim 1, further comprising applying a TiCL₄ TiN layer to at least a portion of the passage before depositing an electrically conductive material into at least a portion of the passage.

[c5] 5. The method of claim 1, further comprising applying a wetting agent to at least a portion of the passage before depositing an electrically conductive material into at least a portion of the passage.

[c6] 6. The method of claim 1, further comprising applying a Ni layer to at least a portion of the passage before depositing an electrically conductive material into at least a portion of the passage.

[c7] 7. The method of claim 1, further comprising:
applying a TiCL₄ TiN layer to at least a portion of the passage; and
applying a Ni layer over at least a portion of the TiCL₄ TiN layer before depositing an electrically conductive material into at least a portion of the passage.

[c8] 8. The method of claim 1, further comprising:
applying a passivation layer to at least a portion of the passage;
applying a TiCL₄ TiN layer over at least a portion of the passivation layer;
and
applying a Ni layer over at least a portion of the TiCL₄ TiN layer before depositing an electrically conductive material into at least a portion of the passage.

[c9] 9. The method of claim 1 wherein forming the passage includes laser-cutting a through-hole completely through the die.

[c10] 10. The method of claim 1 wherein the bond-pad includes a hole filled with a passivation material, and wherein forming the passage includes laser-cutting a through-hole completely through the die and the passivation material.

[c11] 11. The method of claim 1, further comprising:
forming a hole through the first end portion of the conductive line and the bond-pad; and
filling the hole with a passivation material, wherein forming the passage through the die, the bond-pad, and the first end portion of the conductive line includes cutting a through-hole completely through the die and the passivation material.

[c12] 12. The method of claim 1, further comprising:
etching a hole through the first end portion of the conductive line and the bond-pad; and
filling the hole with a passivation material, wherein forming the passage through the die, the bond-pad, and the first end portion of the conductive line includes laser-cutting a through-hole completely through the die and the passivation material.

[c13] 13. The method of claim 1, further comprising:
forming a ball-pad on the second end portion of the conductive line; and
depositing a solder ball on the ball-pad.

[c14] 14. The method of claim 1, further comprising forming a hole in the bond-pad before forming the passage through the die, the bond-pad, and the first end portion of the conductive line.

[c15] 15. The method of claim 1, further comprising:
forming a hole in the bond-pad before forming the passage through the die,
the bond-pad, and the first end portion of the conductive line; and
at least generally filling the first hole with a dielectric material, wherein
forming the passage through the die, the bond-pad, and the first end
portion of the conductive line includes forming the passage through
the dielectric material.

[c16] 16. A method of manufacturing a microelectronic device having a die
with an integrated circuit and a bond-pad electrically coupled to the integrated
circuit, the method comprising:
forming a passage completely through the die and the bond-pad; and
depositing an electrically conductive material into at least a portion of the
passage.

[c17] 17. The method of claim 16 wherein the die includes a first surface and a
second surface opposite to the first surface, wherein forming a bond-pad on the
die includes forming a bond-pad at least proximate to the second surface, and
wherein forming a passage through the die and the bond-pad includes applying a
laser from the first surface of the die toward the second surface of the die to laser-
cut a through-hole through the die.

[c18] 18. The method of claim 16, further comprising applying a passivation
layer to at least a portion of the passage before depositing an electrically
conductive material into at least a portion of the passage.

[c19] 19. The method of claim 16, further comprising applying a $TiCl_4$ TiN
layer to at least a portion of the passage before depositing an electrically
conductive material into at least a portion of the passage.

[c20] 20. The method of claim 16, further comprising:
applying a TiCL₄ TiN layer to at least a portion of the passage; and
applying a Ni layer over at least a portion of the TiCL₄ TiN layer before
depositing an electrically conductive material into at least a portion of
the passage.

[c21] 21. The method of claim 16 wherein forming the passage includes laser-
cutting a through-hole at least through the die.

[c22] 22. The method of claim 16, further comprising:
etching a hole through the bond-pad; and
filling the hole with a passivation material, wherein forming the passage
through the die and the bond-pad includes laser-cutting a through-
hole through the die and the passivation material.

[c23] 23. The method of claim 16, further comprising forming a hole in the
bond-pad before forming the passage through the die and the bond-pad.

[c24] 24. A method of forming a conductive interconnect in a microfeature
workpiece having a die, the die having an integrated circuit and a bond-pad
coupled to the integrated circuit, the method comprising:
forming a hole in the bond-pad;
forming a via completely through the die in alignment with the hole in the
bond-pad, wherein the via and the hole define a passage extending
completely through the die and the bond-pad; and
depositing an electrically conductive material into at least a portion of the
passage.

[c25] 25. The method of claim 24, further comprising insulating the die from the
electrically conductive material in the passage.

[c26] 26. The method of claim 24, further comprising applying an insulating layer to the die proximate to the passage to insulate the die from the electrically conductive material in the passage.

[c27] 27. The method of claim 24, further comprising filling the hole in the bond-pad with a material, wherein forming a passage through the die and the bond-pad includes forming a passage through the die and the material filling the hole in the bond-pad.

[c28] 28. The method of claim 24, further comprising filling the hole in the bond-pad with a passivation material, wherein forming a passage through the die and the bond-pad includes forming a passage through the die and the passivation material filling the hole in the bond-pad.

[c29] 29. The method of claim 24 wherein forming a hole in the bond-pad includes forming a first hole having a first diameter, and wherein forming the passage includes laser-cutting a through-hole having a second diameter, the second diameter being less than the first diameter.

[c30] 30. The method of claim 24, further comprising forming a conductive line electrically coupled to the bond-pad, wherein forming a passage through the die and the bond-pad includes forming a passage through a portion of the conductive line.

[c31] 31. A packaged microelectronic device comprising:
a die having a first surface, a second surface opposite to the first surface,
and an integrated circuit positioned at least partially between the first
and second surfaces;

a bond-pad positioned at least proximate to the second surface of the die and coupled to the integrated circuit, the bond-pad having a third surface at least generally opposite to the first surface of the die; a passage extending completely through the die and the bond-pad from the first surface of the die to the third surface of the bond-pad; and electrically conductive material disposed in the passage from at least proximate to the first surface of the die to at least proximate to the third surface of the bond-pad.

[c32] 32. The packaged microelectronic device of claim 31, further comprising a redistribution layer positioned at least proximate to the second surface of the die, the redistribution layer having a conductive line with a first end portion attached to the bond-pad and a second end portion spaced apart from the bond-pad, wherein the passage extends through the die, the bond-pad, and the first end portion of the conductive line.

[c33] 33. The packaged microelectronic device of claim 31, further comprising: a redistribution layer positioned at least proximate to the second surface of the die, the redistribution layer having a conductive line with a first end portion attached to the bond-pad and a second end portion spaced apart from the bond-pad, wherein the passage extends through the die, the bond-pad, and the first end portion of the conductive line; and a ball-pad disposed on the second end portion of the conductive line.

[c34] 34. The packaged microelectronic device of claim 31, further comprising an insulative layer disposed in the passage between the die and the electrically conductive material.

[c35] 35. A microfeature workpiece having a front side and a back side opposite to the front side, the microfeature workpiece comprising:
a die having an integrated circuit;
a bond-pad electrically coupled to the integrated circuit; and
a passage extending through the microfeature workpiece from the back side to the front side and passing completely through the die and the bond-pad.

[c36] 36. The microfeature workpiece of claim 35, further comprising a metal fill at least partially disposed in the passage and electrically coupled to the bond-pad.

[c37] 37. The microfeature workpiece of claim 35, further comprising a redistribution layer disposed on the die toward the front side of the microfeature workpiece, wherein the redistribution layer includes a conductive line attached to the bond-pad, and wherein the passage further extends through at least a portion of the conductive line.

[c38] 38. A microelectronic device set comprising:
a first microelectronic device having:
a first die with a first integrated circuit and a first bond-pad electrically coupled to the first integrated circuit;
a passage extending completely through the first die and the first bond-pad; and
a metal fill at least partially disposed in the passage and electrically coupled to the first bond-pad; and
at least a second microelectronic device having a second die with a second integrated circuit and a second bond-pad electrically coupled to the second integrated circuit, wherein the second bond-pad is electrically

coupled to the metal fill disposed in the passage of the first microelectronic device.

[c39] 39. The microelectronic device set of claim 38 wherein the first microelectronic device is attached to the second microelectronic device in a stacked-die arrangement.

[c40] 40. The microelectronic device set of claim 38, further comprising a solder ball disposed between the metal fill of the first microelectronic device and the second bond-pad of the second microelectronic device to electrically couple the metal fill to the second bond-pad.

[c41] 41. The microelectronic device set of claim 38 wherein the passage is a first passage and the metal fill is a first metal fill, wherein the second microelectronic device further includes a second passage extending through the second die and the second bond-pad, and a second metal fill at least partially disposed in the second passage and electrically coupled to the second bond-pad.

[c42] 42. The microelectronic device set of claim 38 wherein the passage is a first passage and the metal fill is a first metal fill, wherein the second microelectronic device further includes a second passage extending completely through the second die and the second bond-pad, and a second metal fill at least partially disposed in the second passage and electrically coupled to the second bond-pad, and further comprising:

at least a third microelectronic device having a third die with a third integrated circuit and a third bond-pad electrically coupled to the third integrated circuit, wherein the third bond-pad is electrically coupled to the second metal fill disposed in the second passage of the second microelectronic device.

[c43] 43. The microelectronic device set of claim 38 wherein the first microelectronic device further includes a redistribution layer disposed on the first die, the redistribution layer including a conductive line having a first end portion attached to the first bond-pad, and a second end portion positioned outward of the first end portion, wherein the second end portion is configured to receive electrical signals and transmit the signals to at least the first integrated circuit of the first die and the second integrated circuit of the second die.